A POSSIBLE GENETIC SOURCE FOR CHIPPING POTATOES FROM 40 F STORAGE[1]

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An interspecific hybrid of *S. phureja* x USW1, a haploid of Katahdin, produced acceptable potato chips when processed directly from 40 F (4.5 C) storage during 3 years of testing. It was crossed with 11 interspecific hybrids. Tubers from these progenies were stored for 5 weeks at 40 F and then chipped immediately for 55 seconds in vegetable oil maintained at 375 F (190 C). Of 645 seedlings tested, chip color was acceptable in 17 and variable in 18. A group of 600 seedlings from *S. tuberosum* parents treated comparably produced black-colored chips without exception.

RESUMEN

Un hibrido interspecifico de *S. phureja* x USW1 (haploide de la variedad Katahdin) produjo papas astilladas aceptables.

Estas papas fueron procesadas directamente de un almacen cuya temperatura fue mantenida a 4.5 C. Las pruebas fueron hechas durante tres años.

Este híbrido fue cruzado con once hybridos interespecificos. Tuberculos de estas progenies fueron almacenadas durante cinco semanas a 4.5 C y luego procesadas durante 55 segundos en aceite vegetal mantenido a 190 C. En una prueba de 645 plantas provenientes de estos cruces, se encontró que el color de las papas astilladas era aceptable en 17 clones y variable en 18 clones. Un grupo de plantas procesadas del mismo modo, pero proveninetes de *T. tuberosum* sin exepción produjeron papas astilladas de color negro.

The color acquired by potato chips during frying is due to a complex amino-acid reducing sugar reaction, termed the Maillard reaction (Smith 7). The cultivar and cultural, storage, and frying conditions are important variables influencing this reaction.

With present cultivars, storage at low temperature necessitates reconditioning at higher temperatures to obtain chips with acceptable color. The length of reconditioning time required varies between and within cultivars. Some do not recondition at all; some in a short time, especially some recently introduced cultivars, Jewel (Pratt et al 6), Monona (Stevenson et al 8), Norchip (Johansen et al 3), Oromonte (Twomey 9), Peconic (Peterson and Plaisted 5), Lenape (Akeley et al 1), and Platte (O'Keefe and Werner 4).

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Sometimes a clone will give acceptable chips when chipped directly from cold storage as noted by Hyde and Walkof (2) as well as in our studies. However, these do not perform consistently. Moreover, a judicious choice in frying time and/or oil temperature can enable a marginal clone to produce acceptable chips on occasion. This report details our efforts to identify clones capable of chipping consistently from 40 F (.45 C) storage.

Materials and Methods

In 1965, a search was begun to identify clones capable of chipping from 40 F (4.5 C) storage. During the interim, clones in the Minnesota breeding program were evaluated. Included were old and new selections as well as inbreds from *S. tuberosum* parents and an assortment of interspecific hybrids and their derivatives. Clones reacting favorably were retested in subsequent years.

A stringent testing procedure was chosen. After tubers had been harvested, they were allowed to cure for 2 weeks. They were stored at 40 F (4.5 C) for at least 5 weeks. Upon removal from 40 F, they were immediately made into chips in the Red River Valley Standard Chip Cooker (slices .050″ thick; oil temperature, 375 F; fry time, 55 sec.; oil was 70:30 blend of cottonseed:corn). Preliminary evaluation was by visual inspection. In final evaluation, the lighter samples were crushed and fines removed with 8-mesh screen. The crushed samples were rated in an Agtron Model 500 (small angle viewer) with red filter standardized at 00/0 and 97/97. In this evaluation procedure, potatoes which yield an Agtron reading of 30 or over will make commercially acceptable chips. A few clones were found which produced light-colored chips. Except for Wis. 7334-8, other clones either failed to perform satisfactorily in subsequent tests or were judged virus-infected on the basis of tuber indexing in a greenhouse.

Two clones were chosen for preliminary genetic study, Wis. 7334-8 and Minn. 140. Wis. 7334-8 is an interspecific hybrid of *S. phureja* (P1 225682.40) x USW1, a haploid of Katahdin. In 3 years of testing, it produced the lightest colored chips of all clones tested. Minn. 140 is a *S. tuberosum* selection which sometimes produced light colored chips from cold storage when the oil temperature was reduced. Two sets of progenies were obtained. In one, Wis. 7334-8 was crossed to 11 random interspecific hybrids or their derivatives. In the other, Minn. 140 was crossed to five random *S. tuberosum* clones.

Results and Discussion

A total of 600 and 645 unselected seedlings from Minn. 140 and Wis. 7334-8, respectively, were evaluated. These had been grown in the field as seedling transplants. Those derived from Minn. 140 produced black-colored chips without exception. Of those derived from Wis. 7334-8, 35 seedlings were obtained which produced light-colored chips. As shown in Table 1, the percent of seedlings selected with light colored chips varied, ranging from 16.9% in Progeny 2 to 0.0% in five progenies. The character which makes it possible to produce light-colored chips from 40 F storage appears to be transmitted readily. It is probable that additional

TABLE 1.—*Distribution of seedlings yielding light colored chips when chipped from 40 F storage.*

Progeny	Parentage	Number of seedlings		Percent
		Tested	Selected	Selected
1	Wis. 7334-8 x 80409	88	5	5.7
2	Wi.s 7334-8 x 80390	71	12	16.9
3	Wis. 7334-8 x 80454	50	2	4.0
4	80409 x Wis. 7334-8	76	0	0.0
5	80390 x Wis. 7334-8	54	5	9.3
6	80454 x Wis. 7334-8	55	1	1.8
7	80462 x Wis. 7334-8	56	3	5.4
8	80472 x Wis. 7334-8	51	3	5.9
9	80086 x Wis. 7334-8	51	0	0.0
10	80488 x Wis. 7334-8	40	3	7.5
11	80145 x Wis. 7334-8	19	1	0.5
12	80187 x Wis. 7334-8	17	0	0.0
13	80162 x Wis. 7334-8	14	0	0.0
14	80201 x Wis. 7334-8	3	0	0.0
	Total	645	35	5.4

TABLE 2.—*Agtron color readings*[1] *of selected seedlings chipped from 40 F storage.*

Seedling designate	Agtron color reading[1] Seedling grown in	
	Field	Greenhouse
701	16	40
709	24	28
710	27	20
724	29	40
745	19	37
776	27	23
789	26	30
791	23	22
848	30	19
852	22	27
901	19	30
908	18	19
1045	22	29
1108	25	39
1130	32	22
1132	35	41
1137	26	31
1148	22	37
1209	31	36
1211	27	46
Checks: Wis. 7334-8	28	----
Kennebec, 40 F storage	10	----
Kennebec, 5 weeks 56 F storage	29	----

[1]Red, 00/0 97/97

sources from species hybrids could be found. We only screened about 200 derivatives from species hybrids. On the other hand, our experience suggests that few, if any sources would be found in clones from adapted *S. tuberosum* parents.

Three reciprocal progenies are present in Table 1; namely, Progenies 1 and 4, 2 and 5, and 3 and 6. In each reciprocal, more seedlings were selected when Wis. 7334-8 was the maternal parent. The respective percentages of seedlings selected were 5.7 *vs* 0.0, 16.9 *vs* 9.3, and 4.0 *vs* 1.8. While the data are too meager to come to definite conclusions, there is a suggestion of maternal effect for chipping from 40 F storage.

Table 2 gives Agtron color readings of chips from 20 seedlings grown in both the field and greenhouse. The other 15 seedlings were not included because stock was insufficient to make a reading in tubers from the initial field-grown crop. Readings ranged from 35 to 16 in field-grown selections. The lower readings usually reflect a mixture of light- and dark-colored chips obtained from a seedling. Of the 35 seedlings selected, chip color was uniform in 17 and variable in 18. The readings on chip color from greenhouse-grown tubers were somewhat higher than those from field-grown tubers. These are included to illustrate that acceptable performance continues in these clones under markedly different growing conditions.

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